

CHAPTER 1

INTRODUCTION

1.1 General

1.1.1 Definition

Drug has become an essential item of one's life especially when one is ill. A drug could be of great medicinal value if one takes it in a properly prescribed dosage for treatment, or otherwise it becomes a poison when it exceeds this level. Sometimes, certain drugs are consumed outside therapeutic doses for an unjustified period of time for recreational activities. Such improper use and purposeful exploitation of drugs are called drug abuse. Drugs that are often misused are identified as controlled substances since they have the potential for abuse and may cause a health hazard to the abuser or to others in the community (Karch, 2006). In most circumstances, controlled substances are also known as illicit drugs or narcotics which frequently encompass heroin, cannabis, cocaine, amphetamine, ecstasy pills and others. In drug control, these substances are specifically listed in Schedules I and II of the 1961 Convention (United Nations Office on Drugs and Crime [UNODC], 2003).

In Malaysia, the term 'dangerous drugs' instead of 'controlled substances' is used to describe drugs that are not permitted for production and consumption altogether. The latter term is inappropriate since it refers to restricted rather than banned use of certain substances such as pseudoephedrine which can still be prescribed for the common cold.

1.1.2 Background of the Study

At present, the ever burgeoning illicit drug market keeps policymakers and enforcement bodies alarmed when the sharp increase in the number of drug abuse cases has been reported over the past decade. It has been estimated that 3.3 – 6.1% of the population aged 15 – 64 year-old have used illicit substances at least once in 2009 (UNODC, 2011). The rampant use of drugs therefore constantly gives way to the international body to call for legislation in their efforts to combat substance abuse on a global scale. Chronologically, China took the first move in the global arena in 1907 to limit the local production of opium and its importation from India. In 1909, the United States of America (USA) initiated the Shanghai Conference to limit the use of opium to legitimate medicinal purposes (Roman, Ahn-Redding & Simon, 2005). Subsequently, The Hague Treaty 1912 further endorsed the enactment of legislation in each nation to control the production of crude substances, their manufacture into pharmaceutical products, and their distribution within the nation and abroad (Renborg, 1947). Following such events, all other ensuing interdiction efforts aimed at controlling the drugs of abuse worldwide were also stepped up and they have been reported by Lowinson, Ruiz, Millman and Langrod (2005). After World War II, the World Health Organization (WHO) began to adopt the role as an international regulator in drug interdiction to combat the abuse and trafficking of illicit drugs.

Drugs produced in a country are usually trafficked across the international boundaries. Consequently, drugs that are not produced within a region become accessible to the local inhabitants. In fact, the expansion of the international drug trade has a close link with modernization. With the advent of telecommunication technology, the expanding network of illicit drug markets has made it easier for drug trafficking. Through the Internet, illegal trades are catalyzed by speedy dissemination of information between the dealers in the black market. The Australian Crime Commission

(2011) has recognized online sales as one of the main transaction routes through which illicit products are sold in a transnational manner. As a result, the illicit drugs can easily encroach on other areas previously not 'serviced' with drugs. This results in the prevalence of drug trafficking because deals can be now made more conveniently and quickly via emails, mobile phones, and other telecommunication devices. In future, these illicit drug manufacturers would eventually monopolize the global illicit drug market if they are able to elude the law enforcement authorities. It is therefore important to keep this drug issue at bay before it festers. Hence, this calls for a combined effort from the local and global law enforcement units to implement a harmonized drug interdiction program.

The continuous supply of illicit drugs will eventually lead to other social issues. Unemployment and underemployment are the preliminary signals of these social menaces. Drug addicts often show impaired work efficiency and low productivity. Their underachievement in work will therefore lead to unemployment. Without a constant source of income, it will consequently impel them to seek for the supply of drugs by unlawful means such as burglary, robbery, abduction, smuggling, murder and other criminal activities. Hence, drug abuse is a social menace which leads to criminality. This idea constitutes one of the bases for the restrictive legislation to regulate and control the use of drugs and to suppress its abuse (Prashant, 1993).

In view of the above-mentioned problems, governments of all nations thus do not permit the use of dangerous drugs. The possession and use of these drugs are therefore against the law. When one is prosecuted, it is necessary for the drug analyst to present scientific evidence to the court to prove the presence of the illicit drug in the seizure. Ideally, the forensic investigation should include all information obtained from the scene of the crime, police interrogation and laboratory testing. However, much of the information is undermined at the initial stage especially at the crime scene when

precautions are not taken. Therefore, scientific testing on the seized substances in the laboratory becomes a crucial part in the overall investigation.

Conventional scientific testing is only concerned with the target drug. In the USA, Germany and the Netherlands, extra laboratory effort has been devoted to profiling a comprehensive list of ingredients in the drug sample (Collins, Huttunen, Evans & Robertson, 2007). The aim is to cluster the seized drugs according to the geographical origin. For more than a decade, the profiling of amphetamine-type stimulants (ATS), cocaine and heroin has been routinely performed in these countries. However, none of these drugs has been profiled in such a manner in Malaysia.

Amongst the variety of illicit drugs, heroin remains the leading drug of abuse in most countries in the world. Asia has been identified as one of the major production and consumption sites around the world (UNODC, 2011). Despite the harsh laws being enacted, the abuse and trafficking of heroin still exist. At present, the increasing prevalence of heroin abuse in Malaysia has spurred the local authorities to initiate a profiling program to track down its source using the concept of forensic intelligence. In this effort, a detailed analysis of the drug seizures must be performed in order to derive maximum information from the exhibits.

1.2 Illicit Drug Market

1.2.1 Global Drug Production

According to the World Drug Report 2011 (UNODC, 2011), the largest volume of illicit drugs produced involved the production of cannabis. Other medium sized production included cocaine, heroin and ATS. This report also records that the opium poppy cultivation site in Myanmar rose by 20% from 2009, while coca cultivation declined by 18% from 2007 and cannabis herb cultivation remained stable. The

production of synthetic drugs such as ATS was however difficult to be estimated due to its widespread distribution.

The annual production of drugs presented in Table 1.1 reveals that North America was mainly responsible for cannabis herb and ATS. These illicit products were usually shipped from Mexico and Canada to the USA. Large amounts of coca leaves and raw materials for cocaine production were supplied by Colombia, Peru and Bolivia. The drugs were usually trafficked to North America and Europe. Illicit drug production in Europe was largely confined to cannabis, amphetamines and ecstasy pills, whereas in Africa it was mainly focused on cannabis production. Cannabis resins produced in Morocco were destined for markets in Europe. Afghanistan and Myanmar in Asia continued to be the world's supplier of opium for the drug markets in Europe and China respectively. Methamphetamine production remained its sites primarily in China, Philippines, Malaysia and Myanmar. The cultivation of cannabis plant in Oceania mainly occurred in Australia, New Zealand and some of the small island countries. This cannabis was usually meant for local consumption.

Table 1.1: Seizures of drugs in kilogram equivalent according to regions in 2009

Illicit drugs in different regions	North America	South America, Central America, the Caribbean	Europe	Africa	Asia	Oceania
Opium		74	1,379	57	649,449	
Morphine					23,655	
Heroin	2,853	1,159	28,762	515	42,512	195
Cannabis herb	4,188,620	619,786	623,369	639,769	373,522	1,389
Cannabis resin			198,641	320,600	305,556	
Coca leaf		3,517,918				
Cocaine	132,355	541,070	56,736	956	676	290
Methaqualone				828		
Amphetamine-group of which amphetamine methamphetamine	13,876	189	9,077 8,117	98	41,592 24,772 16,577	253 171
Ecstasy	3,816	54	995	0.02	506	63
Ketamine					10,693	
Lysergic acid diethylamide			0.1			0.03
Benzodiazepines and barbiturates			2,103			
Gamma-hydroxybutyric acid			675			

(Source: World Drug Report 2011)

As can be seen from the global record, the statistics imply regional specialization in drug production. Some countries are inclined towards the production of selected drugs, while other countries rely on others for the drug supply. Most of the drugs are trafficked through special routes to the desired overseas destinations, and the rest are for the local markets. In the web of this international drug trade, many different groups of drug traffickers are involved in the trafficking and sale of the illicit material. Indeed, the overall process is complicated though some knowledge about the illicit drug market obtained by Natarajan and Hough (1998); May and Hough (2004); Ritter (2005, 2006); McSweeney Turnbull and Hough (2008) were mainly through interrogation following the arrests.

1.2.2 Economics of Illicit Drug Trade

Ritter (2005) assumed that many of the principles of economics that apply for the trade of legal goods are also applicable to that of illegal goods. A body of research was established to study the black market using economics approaches. Heroin markets for example were found to be operating based on the basic supply and demand curves, one of the basic principles in economics (Moore *et al.*, 2005). By investigating the black market in this framework, it may provide a better understanding of how the illicit drug trade is done and help to explain how drug dealers sustain in a milieu strictly regulated by the law.

Various definitions of 'drug market' have been enlightened by Ritter (2006). However, the following discussion will only adopt the economist and criminologist's definitions for explanation. Briefly, the former emphasizes the economics of the drug trade system while the latter focuses on the behavior of both drug users and dealers.

Illicit drug markets operate like the legitimate trading procedure. It broadly comprises production, both agricultural and chemical, distribution and sale of the illegal substances. In the drug market, the supply chain can be divided into three categories. First, the task-based category differentiates five actors as grower/producer, manufacturer, importer/smuggler, wholesale distributor and regional distributor (Natarajan & Hough, 1998). Second, the structure-based category identifies the drug organizations/syndicates as freelance, family businesses, communal businesses and corporations (Natarajan & Hough, 1998). Third, the level-based category consists of international trafficking level, regional middle market and local retail level (McSweeney *et al.*, 2008). In general, a drug is passed down from the manufacturer/farmer to the retailers via the dealers. Among all the actors in the supply chain, Reuter, MacCoun and Murphy (1990) estimated that retail dealers faced the greatest risks of arrest and serious injury.

Anecdotally, this market has indirectly merged with the legal product market following the circular flow of income model. O'Connor (2004) posited that the product market represents all purchases of finished goods and services in an economy while the household is the basic consumption unit. The factor market, sometimes called the resource market, represents all purchases of resources in an economy. In the legal factor market, the employees contribute four productive factors (capital, land, labor and entrepreneur) to exchange money in terms of salary, rent, interest and other forms of revenue. The drug syndicates utilize these legal resources including manpower, chemicals and farm to produce illicit drugs for the product market or black market. In 2009, the global opiate and cocaine markets respectively raked in US\$68 billion and US\$85 billion, and such values of the drug trade far exceeded the size of the legitimate economy (UNODC, 2011). Hence, the earnings of the individuals working for illicit drug manufacturers, in fact, were substantial and significantly higher than what they could earn in the legitimate labor market (Levitt & Venkatesh, 2000).

Money gained from the legal factor market by the drug abusers through factor market will inevitably flow into the drug syndicate when they purchase drugs for consumption. The illicit drug will flow from the drug syndicate to the street through the black market as demand continues to exist. Thus, the circular flow of money into the black market will sustain the production of illicit drugs (Figure 1.1). Such a process is however interrupted when the drug consumers are no longer able to generate incomes through the legal factor market and to inject more money into the circular flow. This concept is hypothetical since Coomber (2004) emphasized that the drug markets do not necessarily conform to commonly-held perceptions as the nature of this illicit business is complex. As such, certain aspects in the black market still cannot be thoroughly explained by the usual economic principles.

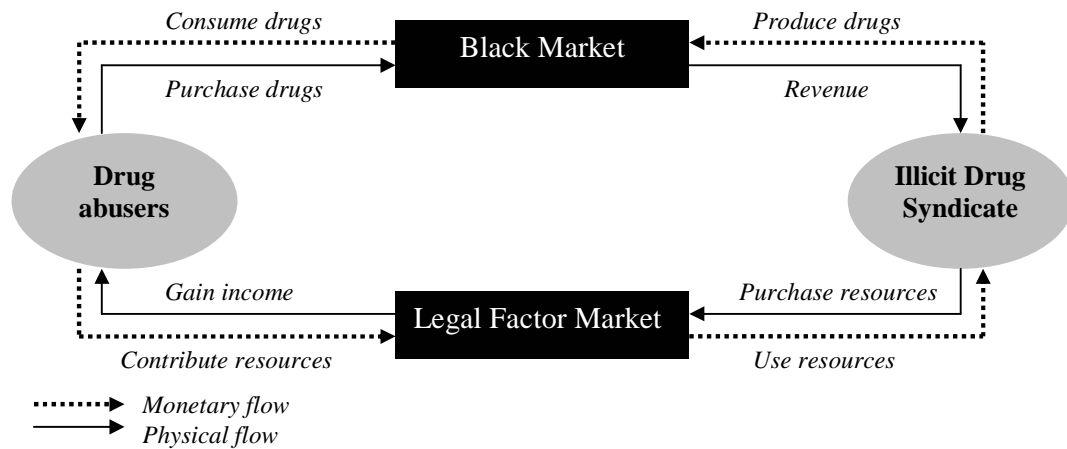


Figure 1.1: Circular flow of income model in illicit drug market

Recently, May and Hough (2004) noted the change of the drug market from an open street-based market to a closed market. They associated this change with the widespread introduction of mobile/cellular phones. With this technology, drug trade seldom takes place in the public domain. This certainly hinders the law enforcement body in locating their hideouts if the transaction is only done underground through telecommunication devices.

The illegal drug trade tends to ramify the transaction process by involving many layers of actors in the distribution chain. In this regard, the police could not track down the origin and locate the syndicate even if the traffickers/agents involved in the distribution chain are apprehended. To sustain this illegal business, these agents are usually not informed of the location of the manufacturing plant. Basically, there are two types of distribution systems – the highly disciplined and hierarchical organization and the smaller structure, fluidity and free enterprise (May & Hough, 2004). The former is not easily traced because the ‘front desk retailer’ does not usually know the ‘back stage wholesaler’. With a multiple layer of actors in the distribution chain, the characteristics of the original drug site inherited in the drug products will therefore be obscured by contamination when the drugs are passed through a long distribution chain.

In the black market, the drug manufacturer is the determining force and the consumers do not have any control in the price and quality of the product. To maximize productivity and minimize production cost, the quality of the drug product is greatly neglected. As a result, many illicit drugs reaching the street level contain very low amounts of active ingredients. In essence, the illicit drug enterprises like all other legal enterprises also resort to product innovation in their business. Crack cocaine is an innovative product which is believed to give enhanced effects compared to its conventional form (Kelly, Moghan & Serio, 2005). The shift from agriculture-based products (e.g. opium) to chemical-based (e.g. ecstasy pills) is another creative breakthrough in the illicit drug industry. As a matter of fact, chemical production is fast and requires short investment as compared to agricultural production. This breakthrough has enabled many drug dealers to earn an even larger sum of money within a short period of time. On the other hand, Natarajan and Hough (2000) asserted that the earnings from this drug trade are not 'easy money' since it also requires considerable knowledge and skills to sustain the business.

1.2.3 Illicit Drugs Differ from Licit Products

Conventionally, illicit and licit drugs are differentiated by the definition stipulated in the law. From the economist's point of view, the basic rights could also be used to differentiate between these products. The consumers of the illicit drug market are denied altogether of the basic consumer rights entitled in the legal transaction. A brief account about the right to safety and the right to redress for illegal products has been given by Borna (1989). Other literature concerning such rights in the illicit drug market is extremely limited. By reviewing these rights, one will notice that the drug actors have infringed on seven of the eight basic consumer rights highlighted by the Consumers International (2009, October 12).

Right to safety: The consumers should be protected against products and services that are hazardous to health or life. However, the illicit drugs sold may contain large amounts of dangerous ingredients (e.g. the illicit drugs and all other adulterants and impurities) that may harm the consumers. In other cases, toxic metals were found in illicit heroin (Infante, Domínguez, Trujillo & Luna, 1999).

Right to be informed: The consumers should be informed of the facts regarding the products and services. However, the illicit drugs do not bear any labeling or markings pertinent to the safety and ingredients of the drugs purchased. Worse still, the ecstasy pills profiled by Hung, Tien and Truong (2005) were merely imitation products as they did not contain the target drug even though they appeared similar to ecstasy pills.

Right to choose: The consumers should be able to choose from a range of products at competitive prices with an assurance of satisfactory quality, however all illicit drugs are sold at exorbitant prices with very poor quality.

Right to be heard: The consumers should have the opportunity to express their ideas for the development of products and services. However, in the black market this opportunity will be denied. The manufacturers will make all the decisions to generate high profits.

Right to redress: The consumers should have access to redress if the product does not meet the intended specification. However, no pay-offs will be made to the consumers and their complaints about the drugs purchased will never be entertained.

Right to education: The consumers should be aware of their basic rights and responsibilities and know how to act on them. However, their rights are denied by the actors of the black market. The consumers will not have access to a legal organization that can provide protection for them because these are illegal markets.

Right to a healthy environment: The consumers should live and work in an environment which does not threaten the well-being of the present and future generation. However, the clandestine laboratories discharge hazardous fumes to the atmosphere and the workers are exposed to hazards in the workplace. For instance, illegal manufacture of methamphetamine has been estimated to result in 5 – 7 pounds of toxic waste for every pound of methamphetamine produced (Phillips, 2004).

These seven aspects not only highlight the deprivation of consumer rights in the illicit drug market, but also provide an additional account to describe the economics of the drug trade.

1.3 The Drug Scene in Malaysia

1.3.1 The Historical Emergence of Drugs of Abuse in Malaysia

Malaysia situated in Southeast Asia is strategically exposed to the lawless region called the 'Golden Triangle'. This region which includes Myanmar, Thailand and Laos is a strategic location for the illegal trafficking of drugs. The 'Golden Triangle' has been known to produce more than 50% of the world's raw opium and refined as much as 75% of the world's heroin (Zhang, 2007). Since Malaysia does not practice a closed-door policy, its porous borders are thus susceptible to the inflow of various dangerous drugs passing through the 'Golden Triangle'.

Drug abuse began in the late nineteenth century when the opium smoking habit was first brought into the Malayan peninsula (former name of Malaysia) by the migrant workers from China. Its abuse was mainly confined to the opiate-based drugs (e.g. opium, heroin and morphine) and cannabis which were and are still smuggled in from the 'Golden Triangle'. In tandem with the advancement of technology, Malaysia received the negative impact of globalization as large amounts of synthetic drugs began to penetrate into every part of the country. The synthetic drugs including

methamphetamine, 3, 4-methylenedioxymethamphetamine (MDMA) and other ATS, need no cultivation but are produced via chemical means. In comparison with the traditional agricultural cultivation, these advanced synthetic methods expedited the production and reduced the cost, making the drugs more affordable to the addicts. Despite this factor, it has not supplanted the opiate-based drugs as the trends in the exploitation of heroin and cannabis remain competitive in most countries.

Based on the chronological reports of drug abuse in Malaysia, the history of drug analysis started in 1972 when heroin was first encountered. The first heroin clandestine laboratory was detected in Bukit Mertajam in 1973. During that period, the definition of raw opium was cumbersome. The revised definition was approved in 1984, during which monoacetylmorphines (MAM) was also listed as a dangerous drug in the laws of Malaysia - Dangerous Drugs Act 1952. Chloroquine was found to be one of the ingredients in heroin concoction in 1985, but its detection in the street samples was only scientifically evident in 1989. The first appearance of MDMA in tablets marked the decline of heroin in 1996. Due to its uncontrolled use, other similar substances such as methylenedioxyamphetamine (MDA), methylenedioxyethylamphetamine (MDEA), methamphetamine and amphetamine were also listed as dangerous drugs in the laws of Malaysia. The anesthetic ketamine made its first appearance in 1998, during which the first methamphetamine clandestine laboratory using hydriodic acid/red phosphorus was found in Sabah. This explains the startling increase in street methamphetamine in both tablet and crystal forms during that time. In 2000, ketamine started to thrive and nimetazepam was introduced into the drug market before both were listed as dangerous drugs in 2001 (Jabatan Kimia Malaysia [JKM], 2001). Another dangerous drug which is classified as a hallucinogen called lysergic acid diethylamide (LSD) was detected in some round black pills known as 'Black Sesame' after a lapse of more than ten years from its last appearance (JKM, 2001).

In 2002, dark brown opium tablets were seized and this marked the revival of the opium market in Malaysia. A notable case involving 5 kg of cocaine in the form of pellets and powder was seized in 2002 and such samples continued to exist in the possession of some foreign drug traffickers entering the country in 2003 (JKM, 2003). On the other hand, ketum containing an active ingredient called Mitragynine played a significant role in 2004. This drug was made into drinks or powders before it was distributed. According to Chan, Pakiam and Rahim (2005), ketum could be an alternative for the abusers to get an emotional 'high' when they are unable to get the regular supply of cannabis or heroin. A psychedelic drug first synthesized in 1974 known as 4-bromo-2, 5-dimethoxy-phenethylamine or 2C-B was found in tablets and detected in another busy town, Ipoh in 2005.

Several methamphetamine manufacturing plants have been detected within the country in recent years. However, there has not been any evidence showing that Malaysia is the cultivation site for poppy crops and cannabis. Vong (2004) attributed this circumstance to the stringent legislative proscription and strict enforcement regime adopted by the Malaysian Government in the campaign against illicit drugs.

1.3.2 The Prevalence of Drugs of Abuse in Malaysia

A multiple set of data were generated from the Linked Information Management System (LIMS) of the Department of Chemistry Malaysia to illustrate the drug scenario in Malaysia. This dataset representing the statistics about the dangerous drug samples submitted for laboratory analysis may be useful to indicate the prevalence of drug abuse in the real setting. In Figure 1.2, there is a gradual increase in the abuse of nearly all kinds of dangerous drugs during 1998 to 2009. Not surprisingly, heroin cases remained high over the years and recorded the highest figure in 2009 (about 11,700 cases). This dangerous drug started to grow in 2000 and a steady increase of 70% was recorded

during the period of 2006 to 2009. In particular, the use of methamphetamine/*syabu* surged from year 2001 (295 cases) to 2009 (7,930 cases). Information obtained from the Malaysian drug enforcement agencies reveals that most of the methamphetamine sold in Malaysia was smuggled from China, Thailand and Philippines (Vong, 2004). The entry of the methamphetamine was not only to meet the street demand; it was also purchased by ecstasy manufacturers to make various designer drugs. In 2000, methamphetamine was found among a host of chemicals and tablet-making devices in a premise illicitly producing ecstasy tablets (JKM, 2000). Cannabis had remained as the second predominant drug of abuse until 2003 before it was superseded by methamphetamine. Apparently, there are two noticeable declines in the usage of cannabis in 2004 and 2008 as shown in Figure 1.2. In terms of the supply, JKM (2004) reported that the majority of the seized cannabis could have originated from Thailand and Indonesia. Opium, whether raw or processed, was the least popular drug of abuse. The prevalence of codeine abuse on the other hand was quite constant throughout the decade.

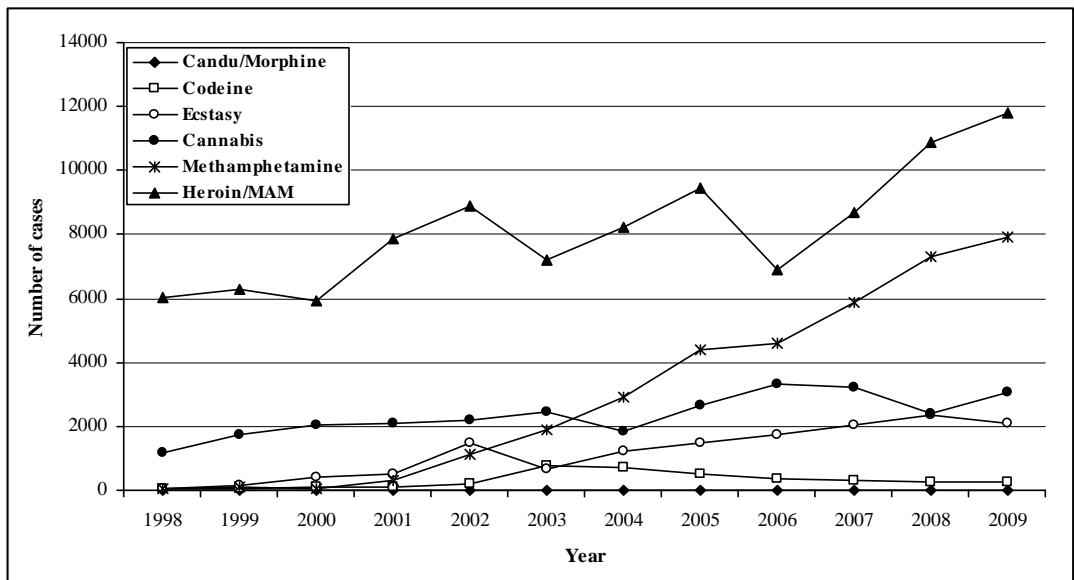


Figure 1.2: Trends in drugs of abuse in Malaysia between 1998 and 2009

The histogram extracted from “Info Pilihan” (2005) provides a snapshot of the distribution for drug addicts within Malaysia between 1999 and 2003. According to Table 1.3, Pulau Pinang had the most drug addicts among other states and the capital, Kuala Lumpur followed closely behind. Among the rest of the states, the new federal territory, Labuan records the least number of drug addicts. An increasing trend in the number of drug addicts is shown in Pulau Pinang, Kuala Lumpur, Sabah and Sarawak. The decrease in the number of addicts on the other hand is also evident in Johor, Melaka, Negeri Sembilan, Terengganu and Labuan. Among the drug users, young people aged 20 – 24 years were found to be the dominant user group for the drug abuse cases in 2005 (“Info Pilihan,” 2005).

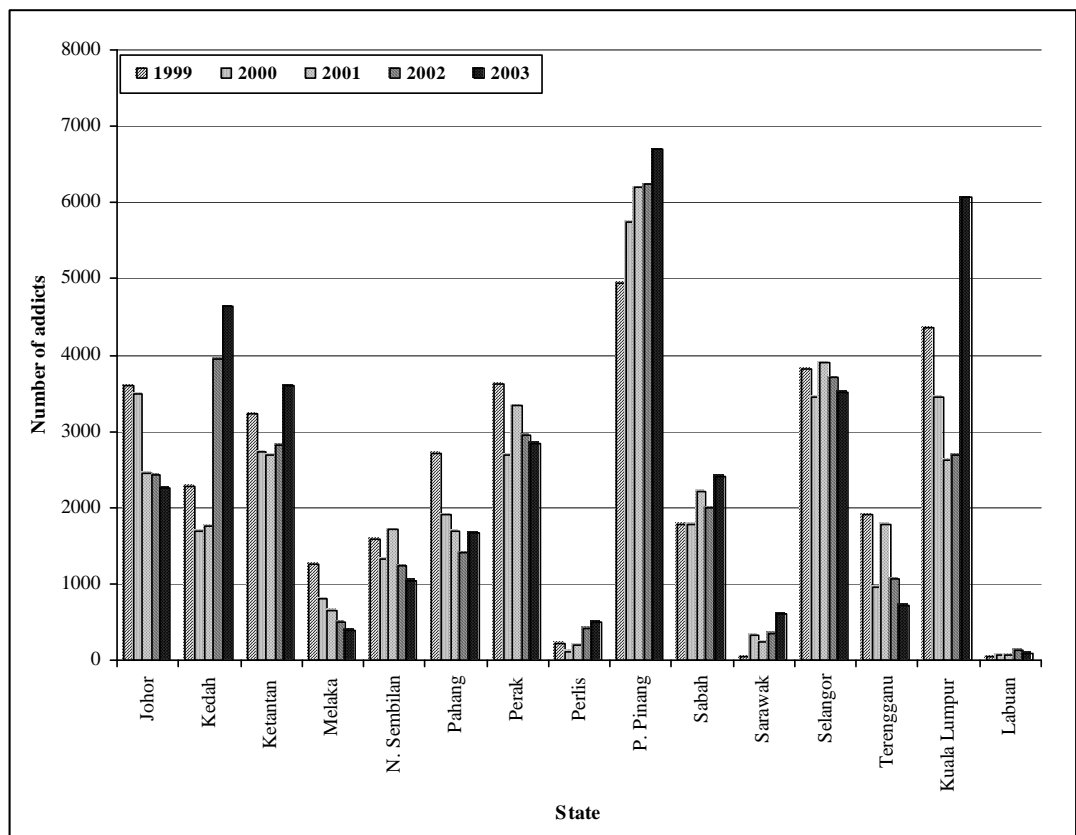


Figure 1.3: Distribution of drug addicts in Malaysia between 1999 and 2003
(Source: Department of Statistics Malaysia)

1.3.3 Dangerous Drugs Act 1952

In Malaysia, the statutory document that spells out the penalties on drug prosecution is the Dangerous Drugs Act (DDA) 1952. To some extent, this legislation sets a standard of severity by the punishments it attaches to various crimes (Adler, Mueller & Laufer, 1998, p. 33). Hence, the sentences imposed by the DDA 1952 can reflect the severity of the drug-related crime. The prosecution often includes self-consumption, possession, manufacturing, trading and trafficking of dangerous drugs as prosecutable crimes. The penalty depends on the net weight of illicit drug contained in the gross sample. Four categories carrying different penalties as stipulated in the DDA 1952 (Legal Research Board [LRB], 2004) are listed as follows:

- Possession: imprisonment of not exceeding 5 years, or a fine not exceeding 20,000 ringgit (RM) or both
- Section 39A(1): imprisonment not less than 2 years but shall not exceed 5 years, and caning of not less than 3 but not more than 9 strokes
- Section 39A(2): imprisonment for life or not less than 5 years, and caning of not less than 10 strokes
- Section 39B: death penalty/capital punishment

In each category, the net weight of illicit drug is specified clearly in the act. The net weight, however, varies according to the drug type. For example, the possession category that accounts for a net weight of less than 2 g heroin, also applies to less than 5 g methamphetamine (The details of the DDA are outside the scope of this study).

Referring to the data (Figure 1.4) provided by the Royal Malaysian Police Department (2009, November 5), the possession cases increase steadily from 1998 to 2007 covering 70 – 90% of all arrests prosecuted under the DDA. This trend infers that

the abuse of dangerous drugs is more acute than trafficking. Cases that fall under Sections 39A(1), 39A(2) and 39B were particularly noticeable in 2001, 2002, and 2007. The chart also shows a constant rise in general for all the categories with a slight decline over 1999 and 2000 compared with 1998. The threefold increase in the number of seized drugs in this 10-year period also attests to the severity of this crime in Malaysia.

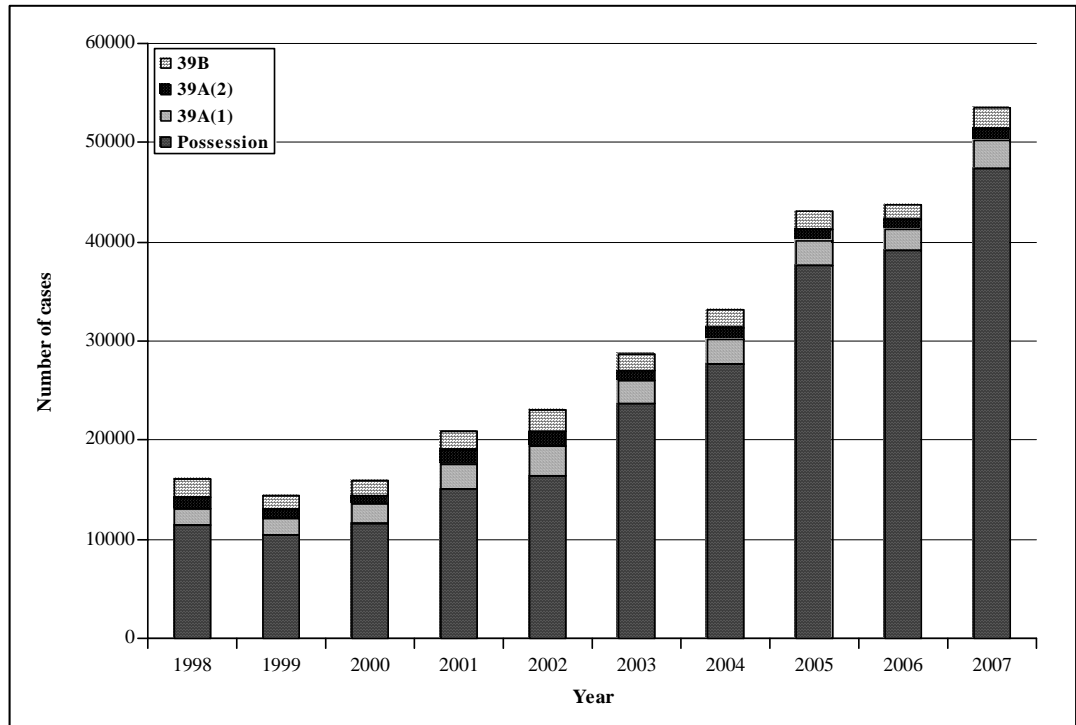


Figure 1.4: Seized dangerous drugs according to the category of DDA 1952 in Malaysia between 1998 and 2007

In summary, the abuse of dangerous drugs in Malaysia is still proliferating. The battle against drugs certainly requires a concerted effort from the enforcement unit and narcotics scientists to beat the black market using scientific approaches.

1.4 Scope of this Study

1.4.1 General Scope

Illicit drugs have sprawled its abuse across the regional and international continents. The actors in the black market are still at large. Many of these criminals perceive that being eventually tracked down by the police is rather a remote apprehension. Therefore, a well planned interdiction strategy must be in place to speed up the tracking process. Dating back to the past three decades, forensic intelligence has emerged to trace the trafficking route and the point of origin using a drug profiling system. In conjunction with this, this study is devoted to the profiling of illicit heroin, the main drug of abuse in Malaysia. All efforts are directed to the physical and chemical characteristics of the heroin samples as well as their associated packages. Each heroin case sample was profiled to provide a unique identity so as to distinguish it from the rest as well as to establish links between similar samples. Their profiles are then collated in a database which will serve as a library for future tracking. Nevertheless, the physical and chemical information will also aid in sample classification which serves to give new tactical and strategic indications for forensic investigations.

1.4.2 Assumptions

To render validity to the research findings, the overall study is guided by the following assumptions:

1. Every part of the sample including its receptacle is a potential source of information. The whole entity of each sample should be analyzed as thoroughly as possible. Detailed profiling of a heroin case and the related receptacles will enhance the discriminative power since every sample acts as a unique entity with its own history. Every investigated aspect shall be useful to provide

information related to the history of the drug which in turn gives a new direction to the drug intelligence activities.

2. Samples after careful subgrouping are homogeneous and representative of its group. Prior to profiling, every heroin sample unit should be treated as a unique entity. A subgrouping system will objectively classify the sample units based on a set of criteria. The classified sample units in a group are assumed to be similar and representative of its batch/source.
3. Simulated links can represent the actual heroin samples. When samples of known sources are unavailable, selected samples can be used to simulate links of related samples that are similar to the actual samples in terms of the chemical composition. When statistical techniques perform well with the simulated samples; they are assumed to be working similarly well with unknown samples.
4. Different markers indicate the relationships between heroin samples at different levels. Any by-products inherited from the manufacture of heroin are useful to trace the production batch of the samples. If natural opium-based alkaloids are used, they would be more useful to indicate the sample relationships at the source/origin level. Physical characteristics are meant for street level comparison.

1.4.3 Objectives of the Study

This study seeks to accomplish six major tasks on the heroin samples. Generally, they include the following:

1. Collection of police information and physical characteristics of the seizures
2. Analysis of plastic packages/films
3. Determination of major components
4. Determination of trace organic impurities
5. Determination of trace elements/metals
6. Development of a database

Each of the above tasks seeks to achieve the following objectives:

1. Development and optimization of a method that is simple and rapid for routine profiling.
2. Validation of the developed method using chemical standards and/or heroin samples.
3. Statistical validation for sample classification using simulated/related samples that are analyzed by the developed method.
4. Instrumental and statistical analyses of heroin samples seized in Malaysia for evidential and forensic intelligence purposes at distribution/street, production/manufacturing and source/origin levels.